

Amendments to the Claims

1-35. (Cancelled)

36. (New) A method of forming a copper interconnection on a semiconductor device, said method comprising:

forming an auxiliary seed layer for reinforcing a copper seed layer in an interconnection groove defined in a surface of the semiconductor device using an electroless copper plating liquid containing i) bivalent copper ions, ii) a complexing agent, iii) an aldehyde acid, iv) an organic alkali, and v) an additive for stabilizing said electroless copper plating liquid and controlling a plating rate, said electroless copper plating liquid containing no endocrine disruptors; and

performing an electrolytic plating process using the seed layer including said auxiliary seed layer as a current feeding layer, for thereby filling copper in the interconnection groove defined in the surface of the semiconductor device.

37. (New) A method according to claim 36, wherein said complexing agent does not contain alkali metals.

38. (New) A method according to claim 37, wherein said complexing agent comprises EDTA·4H (ethylenediaminetetraacetic acid).

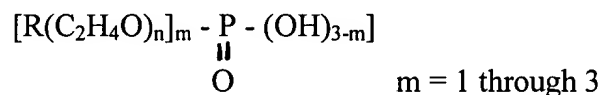
39. (New) A method according to claim 38, wherein said EDTA·4H has a concentration ranging from 0.5 to 100 g/L.

40. (New) A method according to claim 36, wherein said additive comprises at least one of polyoxyethylene alkylether phosphoric acid and polyoxyethylene alkylether.

41. (New) A method according to claim 40, wherein said additive has a concentration ranging from 1 to 100 mg/L.

42. (New) A method according to claim 40, wherein said polyoxyethylene alkylether phosphoric acid and/or polyoxyethylene alkylether has a structure indicated below:

(polyoxyethylene alkylether phosphoric acid)



(polyoxyethylene alkylether)



43. (New) A method according to claim 36, wherein said organic alkali does not contain alkali metals.

44. (New) A method according to claim 43, wherein said organic alkali comprises TMAH (tetramethylammonium hydroxide).

45. (New) A method according to claim 44, wherein the electroless copper plating liquid has a pH adjusted to a range from 10 to 14.

46. (New) A method according to claim 36, wherein said aldehyde acid comprises a glyoxylic acid.

47. (New) A method according to claim 46, wherein said glyoxylic acid has a concentration ranging from 1 through 50 g/L.

48. (New) A method according to claim 36, wherein said copper ions have a concentration ranging from 0.01 to 10.0 g/L.

49. (New) A method for forming copper interconnections within recesses in a surface of a semiconductor substrate, said method comprising:

providing a substrate with a copper seed layer within recesses in a surface of the semiconductor substrate;

forming an auxiliary copper seed layer for reinforcing the copper seed layer within the recesses using an electroless copper plating liquid excluding endocrine disruptors at a plating rate of equal or less than 50 nm/min, said electroless copper plating liquid containing i) bivalent copper ions, ii) a complexing agent, iii) an aldehyde acid, iv) an organic alkali, and v) an additive for stabilizing said electroless copper plating liquid and controlling a plating rate, said additive containing no endocrine disruptors; and

filling copper in the recesses by an electrolytic plating process using the reinforced copper seed layer as a current feeding layer.

50. (New) A method according to claim 49, wherein at least one of the recesses has an inlet size of less than 0.18 μm .

51. (New) A method according to claim 49, wherein said complexing agent does not contain alkali metals.

52. (New) A method according to claim 51, wherein said complexing agent comprising EDTA·4H (ethylenediaminetetraacetic acid).

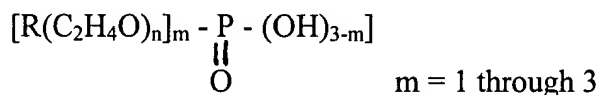
53. (New) A method according to claim 52, wherein said EDTA·4H has a concentration ranging from 0.5 to 100 g/L.

54. (New) A method according to claim 49, wherein said additive comprises at least one of polyoxyethylene alkylether phosphoric acid and polyoxyethylene alkylether.

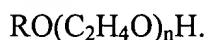
55. (New) A method according to claim 54, wherein said additive has a concentration ranging from 1 to 100 mg/L.

56. (New) A method according to claim 54, wherein said polyoxyethylene alkylether phosphoric acid and/or polyoxyethylene alkylether has a structure indicated below:

(polyoxyethylene alkylether phosphoric acid)



(polyoxyethylene alkylether)



57. (New) A method according to claim 49, wherein said organic alkali does not contain alkali metals.

58. (New) A method according to claim 57, wherein said organic alkali comprises TMAH (tetramethylammonium hydroxide).

59. (New) A method according to claim 58, wherein the electroless copper plating liquid has a pH adjusted to a range from 10 to 14.

60. (New) A method according to claim 49, wherein said aldehyde acid comprises a glyoxylic acid.

61. (New) A method according to claim 60, wherein said glyoxylic acid has a concentration ranging from 1 through 50 g/L.

62. (New) A method according to claim 49, wherein said copper ions have a concentration ranging from 0.01 to 10.0 g/L.